Invention Journal of Research Technology in Engineering & Management (IJRTEM)
ISSN: 2455-3689
www.ijrtem.com Volume 2 Issue 6 ǁ June 2018 ǁ PP 107-113

Comparative Analysis of Coconut shell Concrete to Traditional Concrete

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ABSTRACT : *It is found that so many wastes which can be used in traditional concrete like e-wastes, rubber tyre waste, glass waste etc. The coconut shell is also a main waste which can be used in traditional concrete. Generally, coconut shells are used in traditional concrete in the form of viz., coconut shell aggregate and coconut shell fiber. This paper describes coconut shells are used as replacement of coarse aggregates. The compressive and flexural strength test where taken on 10%, 20% and 30% replacement of coarse aggregate to coconut shells. It is observed that the compressive strength of concrete is reduced in some extent and the flexural strength also reduced as replacement of coconut shell is increased, but the 10% replacement is possible to use in construction work and 20% and 30% replacement are possible to use for less important construction work under some conditions.*

It is found that, workability of concrete is increased than traditional concrete as percentage replacement is increased. Total cost of concrete is get reduced by replacement of coarse aggregate to coconut shells. The volume of concrete is also increased as replacement is increased, hence, the total quantity of concrete required is getting reduced and the cost is again getting reduced. This paper supports the "SWACHHA BHARAT ABHIYAN" carried by our Hon. Prime Minister Narendra Modi.
Finally, this paper concluded that, the Coconut Shell is possible to use for construction work as coarse aggregate under some conditions economically. It is majorly used for construction of small huts, watchman cabin, farm house in forest areas and small houses etc.

KEYWORDS: *Coconut Shell, Compressive strength, Flexural Strength, Mix Design, Cost Comparison,*

I. INTRODUCTION

Concrete is worlds most widely used construction material. The utilization of concrete is increasing at a higher rate due to development in infrastructure and construction activities all around the world However there are some negative impacts of more production of concrete like continuous extensive extraction of aggregate from natural resources will lead to its depletion and ecological imbalance Researchers are in search of replacing coarse aggregate to make concrete less expensive and to lead sustainable development This environmental reason has generated a lot of concern in the construction world. The use of sugarcane bagasse wooden chips, plastic waste, textile waste, polyethylene, rice husk ash, rubber tyres, vegetable fibers, paper and pulp industry waste, groundnut shell, waste glass, broken, bricks are some examples of replacing aggregates in concrete

Modification in Concrete: This has necessitated research into alternative materials of construction. There is an increasing interest in what happens to products at the end of their useful lives, so natural materials have an advantage in that they can biodegrade or burnt in a carbon-neutral manner. Concern for sustainable development has emerged as one of the major societal issues of the late 20th century. This pertains among others to environmental issues and the conservation of natural resources. The beginnings of this awareness are difficult to pinpoint, but it is clear that it did not originate in the United States, where a public accustomed to an abundance of natural resources was relatively late to realize the limits of these resources and the real costs associated with their wasteful exploitation. But at present, environmental consciousness is being encountered in all walks of life. In the construction industry, increasing attention is being paid to the concept of "green buildings". The search for "green" or environmentally friendly materials in the building industry involves the development of new materials but might also lead to the reconsideration of traditional ones. The use of sugarcane bagasse wooden chips, plastic waste, textile waste, polyethylene, rice husk ash, rubber tyres, vegetable fibers, paper and pulp industry waste, groundnut shell, waste glass, broken, bricks are some examples of replacing aggregates in concrete

Necessity of Development: Coconut shell is categorized as light weight aggregate. The coconut shell when dried contains cellulose, lignin, pentosans and ash in varying percentage In Asia, the construction industry is yet to realize the advantages of light weight concrete in high rise buildings Coconut shells are not commonly used in construction industry and are often dumped as agricultural waste. The aim of this research is to spread awareness of using coconut shell as partial replacement of coarse aggregate in concrete and technical and economical feasibility of the same The concrete obtained using Coconut Shell aggregates satisfies the minimum necessities of concrete. Coconut Shell concrete has superior workability because of the smooth surface on one side of the shells. The impact resistance of Coconut Shell concrete is high when compared with conventional concrete. Moisture retaining and water absorbing capacity of Coconut Shell are more compared to conventional aggregate. The amount of cement content may be more when Coconut Shell are used as an aggregate in the production of concrete compared to conventional aggregate concrete. The presence of sugar in the CS as long as it is not in a free sugar form, will not affect the setting and strength of concrete. It is found that wood-based materials, being hard and of organic

Objectives

1. Collection of material and finalization of replacement percentage of coarse aggregate.
2. Casting of cube moulds and beam moulds and taking tests on them.
3. Analyzing of tests results and economical feasibility
4. To find economical and environmental helpful solution for high cost of concrete.

II. INTRODUCTION OF WASTE MATERIAL

A research effort has been done to match society□s need for safe and economic disposal of waste materials. The use of waste materials saves natural resources and dumping spaces and helps to maintain a clean environment. The current concrete construction practice is thought unsustainable because, not only it is consuming enormous quantities of stone, sand and drinking water, but also two billion tons a year of Portland cement, which releases green-house gases leading to global warming. Experiments has been conducted for waste materials like- rubber tyre, e-waste, coconut shell, blast furnace slag, waste plastic, demolished concrete constituents, waste water etc. Construction waste recycle plants are now installed in various countries but they are partly solution to the waste problems. Following a normal growth in population the amount and type of waste materials have increased accordingly. Many of the non-decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, there by contributing to the environment problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the ‘’ WASTE HIERARCHY’’.

Its aim is to reduce, reuse, or recycle waste the latter being the preferred option of waste disposal.

Use of Waste in Concrete:

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Types of Waste

E-waste

- E-Waste is any refuse created by discarded electronic devices and components as well as substances involved in their manufacture or use.
- Examples: computers, office electronic equipment, entertainment device electronics, mobile phones, television sets and refrigerators.
- The e waste in India for the year 2005 has been estimated to be 146180.00 tones.

- Ten states generate 70% of the total e waste generated in India the Maharashtra ranks first.

Rubber Tyre Waste

- Discarded vehicle tires constitute one important part of solid waste which has historically been disposed of into landfills.
- Recycled waste tire rubber has been used in different application. It has been used as a fuel for cement kiln, as feedstock for making carbon black and as artificial reefs in marine environment.

Crushed Glass

- Crushed glass can also be used as an alternative to aggregate in concrete and this type of concrete is known as glass Crete.
- As a construction material, the glass offers several advantages that could be exploited in the concrete industry. Some of this advantages properties are given below
- The very significant hardness of glass gives the glasscrete and abrasion resistance that very few natural stone aggregate can match. Because glass aggregate has basically 0 water absorpsion. It improves the flow properties of fresh concrete so that a reduction in water content can be obtained even without the use of water reducing admixture. The high chemical resistance of the glass to acidic solution makes it suitable be applied to cases when the exposure to the chemicals is expected

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Coconut Shell

- It is an agricultural biodegradable waste found in most of tropical countries especially in Asia.
- India manufacture 15,730 million nuts annually, which is next to Indonesia with 16,498 million.
- Coconut shells dumped improperly to the environment provide breeding places for disease vectors such as rats and mosquitoes.
- It is a light weight material which is becoming much popular nowadays because of its easy handling and low dead loads.
- It is a good alternative to wood and helps to prevent deforestation and also inexpensive.
- Coconut shell exhibits more resistance against crushing, impact and, compared to crushed granite aggregate.
- Coconut shell can be grouped under lightweight aggregate.
- There is no need to treat the coconut shell before use as an aggregate except water absorption.
- Coconut shell is compatible with the cement.
- Coconut shell aggregate is a potential construction material and simultaneously reduces the environmental problem of solid waste and is readily available at a lower cost than normal aggregates

Coconut Shell: Making It an Aggregate

1. Here coconut shell which were already broken into two pieces were collected from local temple, river side etc.
2. Removed fiber and husk from dried shells.
3. All the shells are first washed out and cleaned with water to remove any material present in it as well as smell from the shells.

4. Air dried five days approximately at the temperature of 250 to 300 c.
5. Further the shells are broken into small pieces approximately 16mm by using hammer.

Fig. No. 2.1 Coconut Shell Aggregate

6. These broken shells were Sieved through the sieves of 16mm sieve and retained on 10 mm sieve was taken for the replacement of course aggregate.
7. The material retained on 16mm sieve was discarded.
8. The quantity of total material of coconut shells is taken out and that much of coconut shells are prepared.

TESTS AND RESULTS: Following are the various tests and its result which are taken on coconut shells

Specific Gravity Test

The Specific Gravity of Coconut Shell as shown in fig 3.1 is 1.34 and that of Aggregate is 2.77.

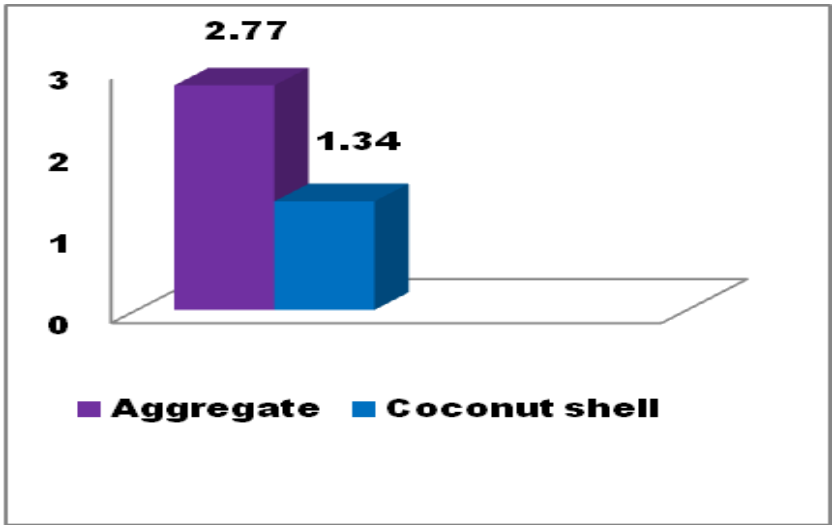

Fig. No. 3.1 Specific Gravity Test Results

1.2 Water Absoption Test

Water absorption for coconut as shown in fig 3.2 is 0.22 and that of aggregate is 0.66.

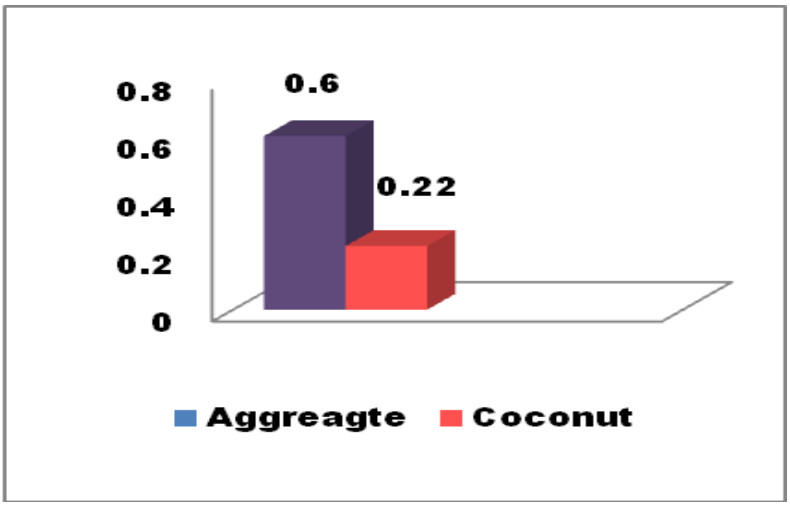

Fig. No. 3.2 Water Absorbsion Test Result

3.3 Mix Design

For M-20 grade concrete, mix design is carried out by IS code method as shown in Table 3.1

Table No. 3.1 Mix Proportion

Mix proportion	For 1 M^3
Cement	310 kg/m^3
Water	186 kg/m^3
Fine aggregate	689.38 kg/m^3
Coarse aggregate	1197.23 kg/m^3
Water cement ratio	0.6

Cost Comparison: As per various research articles, it is decided to replacement course aggregate by coconut shell 10%,20% and 30%. Cost comparison for 1cum concrete as shown in table 3.2.

Table No. 3.2 Cost Comparison

Materials	Rate (Rs)	Cost of concrete (Rs)			
		PCC	10% replacement	20% replacement	30% replacement
Cement	6.4/kg	2080/-	2080/-	2080/-	2080/-
Sand	2800/br	545/-	545/-	545/-	545/-
20 mm Aggregate	2300/br	305/-	305/-	305/-	305/-
Total (Rs)		3180/-	3130/-	3105/-	3080/-
Percentage Reduction in cost			2%	3%	4%

Slump Cone Test: Before preparation of mould it is carried out slump cone test for concrete without replacement of course aggregate, 10% replacement, 20% replacement and 30% replacement as shown in fig.3.3

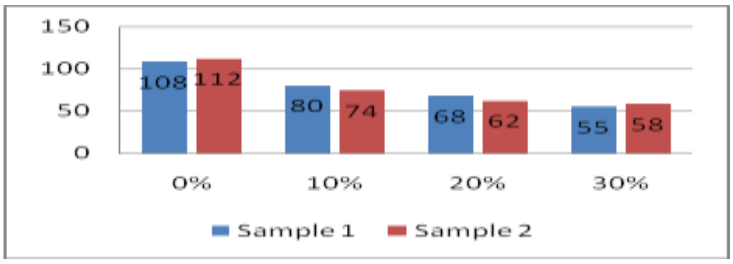

Fig. No. 3.3 Results of Slump Cone Test

Compressive Strength Result: After 28 days curing of concrete cube of 0%, 10%, 20%, and 30% course aggregate replacement are used for compressive strength test. Its compressive strength comparison as shown in fig. 3.4

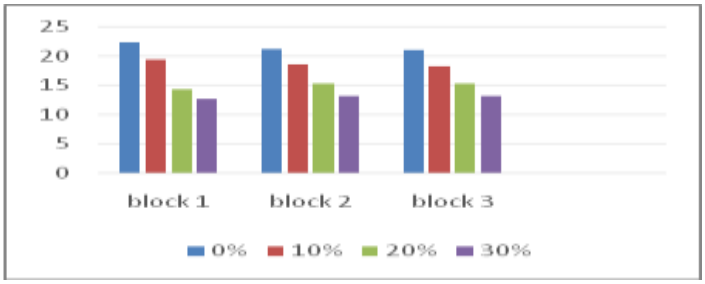

Fig. No. 3.4 Graph for 28 Days Compressive Strength Comparison

3.7 Flexural Test

After 28 days curing of concrete beam of 0%, 10%, 20%, and 30% course aggregate replacement are used for flexural strength test. Its flexural strength comparison as shown in fig. 3.5

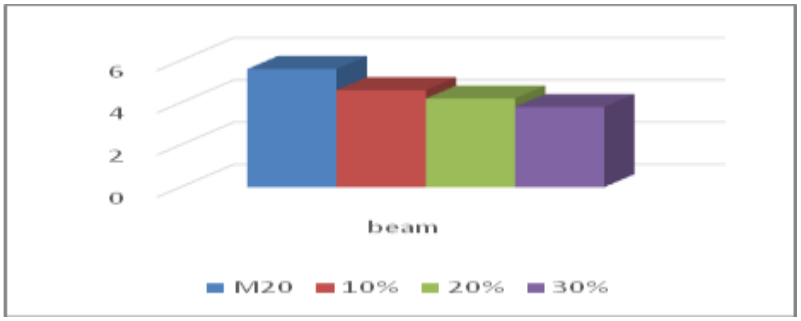

Fig. No. 3.5 Comparison of Flexural Strength Result

III. DISCUSSION

- With respect to above results it is prove that the compressive strength is less as percentage increases of coconut shells. Hence, we can use 10 % and 20 % replacement but if 30 % replacement is done then the compressive strength is very less and cannot useful and uneconomical in any construction work.
- The compressive strengths obtained by 10 %, 20% and 30% replacement are 94 %, 80% and 70% of the total compressive strength of conventional (M20 grade) concrete.
- The flexural strength which was taken on beams is reduced by 17.86%, 25% and 30.36% for replacement of 10%, 20% and 30% respectively. Hence 10% replacement is allowable in construction members and 20 % and 30 % replacement is used in some conditions
- The total quantity required for making beams and cubes is reduced by 4 %, 7%, 15% material is remaining for 10%, 20%and 30% respectively, hence as volume of coconut shells is increased.
- The total cost of the concrete is also affected when the coconut shells replaced by coarse aggregate. The cost is reduced by 2%, 3% and 4% as replacement is done by 10%, 20% and 30% respectively.

IV. CONCLUSION

- The compressive strength of concrete is get reduced by 6%, 20% and 30% for replacement of 10%, 20% and 30% respectively. With respect to this conclusion it is proved that replacement of 10 % aggregate is allowable in normal construction work but 20% and 30% replacement of aggregate is done only for less importance works of constructions.
- The flexural strength of concrete is also get reduced by nearly 18%, 25% and 31% after the replacement of 10%, 20% and 30% respectively. Hence only 10% replacement can be used in any structural member.
- The total weight of concrete is reduced than traditional concrete and the quantity of material is increased with 4%, 7% and 15% by replacement of 10%, 20% and 30% replacement of aggregate respectively.
- The workability of concrete is tested by slump cone test, as percentage of aggregate is increased the slump value is decreased i.e. the workability of concrete is increased as percentage of coconut shells increased.
- The segregation and bleeding is get increased as compaction is increased hence extra compaction reduce the strength of concrete.
- Cost Analysis is depending upon the quantity, quality, and proportion of materials used. Coconut shell in concrete not only changes the strength property of concrete but also changes the cost of that particular design. The total cost of concrete is get reduced by 2%, 3% and 4% for replacement of 10%,20% and 30% respectively.

  Finally, it is concluded that, the Coconut Shell is possible to use for construction work as coarse aggregate under some conditions economically. It is majorly used for construction of small huts, watchman cabin, farm house in forest areas and small houses etc.

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